

Bureau of Land Management

Serial Number  
NMNM 128496

Mineral Report

**Mineral Potential of the Las Cruces Safety Complex**

Lands Involved

New Mexico Principal Meridian, New Mexico

T. 23 S., R. 2 E.,

sec. 3, lots 1 and 2, SW $\frac{1}{4}$ NE $\frac{1}{4}$ , N $\frac{1}{2}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ , SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ , E $\frac{1}{2}$ W $\frac{1}{2}$ W $\frac{1}{2}$ E $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ ,  
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346.59 acres

Prepared by:

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Geologist

title

November 8, 2013

date

Technical Approval:

Robert F. King

Mining Engineer

title

11/15/2013

date

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title

11/22/13

date

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## **Executive Summary**

The subject tract has high potential for the occurrence of geothermal and sand and gravel resources. All other mineral resources are believed to have low, undetermined, or no mineral potential.

The potential for exploration/development of the geothermal resources is probable for the foreseeable future given the push for alternative energy sources. The proposed R&PP development should not cause surface interference with geothermal development. In fact, geothermal development and the proposed R&PP development could be complimentary as geothermal could be used to heat the proposed fire and police stations.

Sand and gravel deposits occur on the subject lands and have been mined in the past. The author has no information as to the quality and quantity of remaining resources. BLM records show there were a number of mineral material sales in the 1980's but there has been no activity since 1988 with the exception of a small amount of rock crushed in 2000. The interest in developing sand and gravel on the tract seems to have diminished. However, demand for resources remains high given the continued growth of the Las Cruces area. The proposed R&PP development could pose an impediment to sand and gravel leasing. However, sand and gravel deposits are widespread around Las Cruces and future demand will be met from other sources.

The lands are classified as prospectively valuable for oil and gas but based upon the drilling results of a nearby exploratory well, there is very low potential for drilling on the subject tract for the foreseeable future.

I recommend that the proposed action be approved based upon the low probability of surface interference with mineral development.

## **I. Introduction**

### **A. Purpose.**

This mineral potential report is prepared for a Recreation and Public Purpose lease and/or conveyance application by the City of Las Cruces. Las Cruces proposes to construct a Public Safety Complex and recreational park center. In accordance with the R&PP Act, public lands will be leased or conveyed to the city with the mineral estate reserved to the United States, together with the right to prospect for, mine, and remove the minerals. The City of Las Cruces proposes to construct buildings for a fire station and a police substation, a trail network and sports fields. This report will discuss the potential for the occurrence of mineral resources, there development potential and interference with the proposed surface use.

### **B. Lands Involved.**

In accordance with Section 7 of the Taylor Grazing Act (43 U.S.C. 315f), the following public land in Doña Ana County, New Mexico, has been examined and found suitable for classification for lease and/or conveyance to the City of Las Cruces under the provisions of the R&PP Act, as amended (43 U.S.C. 869 et seq.):

New Mexico Principal Meridian, New Mexico

T. 23 S., R. 2 E.,

sec. 3, lots 1 and 2, SW $\frac{1}{4}$ NE $\frac{1}{4}$ , N $\frac{1}{2}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ , SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ , E $\frac{1}{2}$ W $\frac{1}{2}$ W $\frac{1}{2}$ E $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ , E $\frac{1}{2}$ W $\frac{1}{2}$ E $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ , E $\frac{1}{2}$ E $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ , E $\frac{1}{2}$ W $\frac{1}{2}$ E $\frac{1}{2}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ , E $\frac{1}{2}$ E $\frac{1}{2}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ , E $\frac{1}{2}$ W $\frac{1}{2}$ E $\frac{1}{2}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ , E $\frac{1}{2}$ E $\frac{1}{2}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ , W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ , SE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ , W $\frac{1}{2}$ SE $\frac{1}{4}$ , and SE $\frac{1}{4}$ SE $\frac{1}{4}$ .

The area described contains 346.59 acres and is managed by the Bureau of Land Management.

Currently, the tract is open public land but in the past it has been used for sand and gravel mining and grazing. Housing developments encroach to the western boundary of the tract and Sonoma Ranch Boulevard crosses the southwest corner of the property (Fig. 1). Several utility rights-of-way cross the tract. Power and communication are readily available but water would have to be provided or developed.

## **II. Description of Geology**

### **A. Physiography**

The subject lands occur within the Basin and Range physiographic province characterized by north-trending structural uplifts separated by broad alluvial basins. The tract is about two miles east of Las Cruces, New Mexico and located on the piedmont between the Mesilla Valley to the west and the Organ Mountains to the east (Fig. 2). The piedmont is dissected by arroyos and the tract is located on a ridge comprised of alluvium between the North Fork Las Cruces Arroyo and the South Fork Las Cruces Arroyo. The elevation of the tract is between 4200 and 4300 ft above

sea level with 100 ft of relief (Fig. 3). The topography has been altered by historic sand and gravel mining which has left leveled areas and mine pits.

#### B. Rock Units (lithology and stratigraphy)

The subject lands are underlain by coarse-grained clastic sediments of the Camp Rice Formation that were shed from the mountains bordering the Mesilla basin (Fig. 4). The sediments were deposited in alluvial fan and axial-fluvial depositional settings during the most recent stage of crustal extension in the Rio Grande Rift and correspond to the appearance of the ancestral Rio Grande in southern New Mexico (Mack et al., 1998). The Camp Rice Formation consists of gravel/conglomerate with minor amounts of sand/sandstone and mudstone. The amount of cementation and consolidation varies considerably and caliche and pedogenic horizons are common. The age of the formation is Pliocene – early Pleistocene.

The Organ Mountains seven miles to the east are largely comprised of a quartz monzonite batholith of Oligocene age (McLemore et al., 1996). Tortugas Mountain 2.5 miles southeast of the tract is an inselberg comprised of the Hueco Formation (Fig. 4), predominantly a carbonate rock of Permian age. A wildcat exploratory well drilled in section 11, less than 0.5 miles southeast of the subject tract, indicates Paleozoic sedimentary rocks underlie the Camp Rice Formation in this area (IHS, 2013). The well was spud at an elevation of 4316 ft and recorded the following formation tops: Pennsylvanian 1580 ft, Mississippian 1790 ft, Fusselman Formation (Silurian) 2,150 ft, El Paso Formation (Ordovician) 2,928 ft.

#### C. Structural Geology and Tectonics

The subject lands occur within the Rio Grande Rift, a zone of crustal extension that extends from northern Chihuahua to northern Colorado. In New Mexico, the Rio Grande Rift largely defines the eastern limit of the Basin and Range Province. The Rio Grande Rift was formed as part of and as a result of the much wider-spread Basin and Range deformation event although it has a structural style that differs from the latter (Baldrige et al., 1984). It is characterized by a series of north-trending, deep grabens and syn-tectonic volcanism although in southern New Mexico it is not physiographically distinctive from the rest of the Basin and Range province.

The Mesilla Basin is a Rio Grande Rift graben. Between it and the west-dipping Organ Mountains uplift is a low-relief horst block mostly buried under the Camp Rice conglomerate but exposed in Tortugas Mountain (Fig. 5). This narrow, northwest-trending horst appears to extend under the subject lands (Fig. 6). Part of the Organ Mountains uplift contains the remnant of a volcanic caldera that formed near the beginning of Basin and Range deformation. The volcanic fill of this caldera is inferred to lie underneath the Camp Rice Formation a short distance east of the subject lands.

#### D. Historical Geology

Southern New Mexico was part of the Pedregosa Basin throughout much of the Paleozoic Era and was the locus of several thousand feet of sedimentary rocks, predominantly marine carbonates and mudstones. Widespread tectonic deformation occurred in the Pennsylvanian

Period with the collision of the North American and African tectonic plates resulting in the Pedernal Uplift in central New Mexico and the formation of smaller, local basins. The area of the subject lands became part of the Orogrande basin which received shallow marine and continental sediments. The area was arched into a positive area during the Laramide Orogeny, a period of compressional tectonism. Extensional tectonics began to deform southern New Mexico in the mid-Tertiary and was accompanied by extensive volcanism. The Rio Grande Rift was a late stage development of the Basin and Range orogeny. The ancestral Rio Grande was established in the Pliocene and entrenchment of the current floodplain began about 0.78 million years ago (Mack et al., 1998).

### **III. Description of Energy and Mineral Resources**

#### **A. Known Mineral Deposits**

The ancient fluvial and conglomerate sediments exposed in the piedmont slopes are a major source of sand and gravel up and down the Mesilla Valley (Austin et al., 1998). Sand and gravel has been mined from the Camp Rice Formation within the subject tract.

Three miles south of the subject tract is the Tortugas Mountain District. Tortugas Mountain is a faulted and rotated exposure of Paleozoic carbonate rock and is part of a horst block that is mostly buried beneath alluvium. Hydrothermal deposits of barite, fluorite and manganese occur along faulted limestone and dolomite. Mineralization occurs as open-space fillings of faults and fractures precipitated from low-temperature water in rift basins heated by convection in the Rio Grande Rift (McLemore et al., 1998). From 1919 to 1943, 20,751 tons of fluorite and 100 tons of barite were produced and a mill operated from 1927 to 1933 (McLemore, 1998). Ore averaged 77.4%  $\text{CaF}_2$  and was mined from numerous adits, shafts and pits. The largest fluorite-calcite vein was up to ten feet thick and was mined to a depth of 530 ft.

Eight miles east of the subject tract is the Organ Mountains District. Copper, lead, zinc, silver and gold has been mined from skarn, replacement and epithermal vein deposits. Mineral zoning and alteration assemblages suggest that district is a porphyry copper/molybdenum system.

The Basin and Range province of southern New Mexico is an ideal area for geothermal resources. Many of the basins contain anomalously-high geothermal gradients and there is widespread Late Tertiary volcanism. The Las Cruces East Mesa geothermal field lies just east of Las Cruces and contains many of the characteristics favorable for convective geothermal heat flow (Ross and Witcher, 1998). The field is defined by numerous temperature-gradient measurements and is coincident to a shallowly-buried, northwest-trending host block. The exposed part of the horst block, Tortugas Mountain, is heavily fractured and ideal for upward movement of thermal waters. The horst block is adjacent to the Organ caldera, and the bounding faults are ideal conduits for the downward flow of meteoric waters to come into contact with a magma or pluton heat source (Fig. 5). Temperature gradients around Tortuga Mountain exceed  $400^\circ\text{C}/\text{km}$  and the resource has been developed for heating commercial greenhouses and space heating and hot water for New Mexico State University.

## B. Known Prospects, Mineral Occurrences, and Mineralized Areas

No known prospects, mineral occurrences of mineralized areas occur within or near the tract.

## C. Mining Claims, Leases and Material Sites

There are no mining claims, leases or material sites encumbering the tract. Historically, sand and gravel mining occurred from a number of negotiated mineral material sales and on mining claims located before 1955 which precluded the requirement for a mineral material sale. One such mining claim was patented in the east half of Section 3 (Fig. 1). All other claims are closed and the last mineral material sale occurred in 2000.

## D. Types of Mineral Deposits

Sand and gravel deposits have been mined from the subject lands. The deposits occur in the Camp Rice Formation which contains sand and pebble- to cobble-size gravel deposited in fluvial facies of the ancestral Rio Grande (Seager et al., 1987). The gravel consists of subangular to subrounded siliceous pebbles which make it ideal for construction concrete. The author has no information as to the quality and quantity of remaining resources.

# IV. Potential for the Occurrence of Mineral Resources

## A. Coal

The Camp Rice Formation alluvial basin-fill sediments and the underlying marine carbonate sedimentary rocks are not a favorable geologic environment for the accumulation of coal resources. Therefore, there is no potential for coal, certainty level D.

## B. Oil and Gas

The subject tract is considered to be prospectively valuable for oil and gas (De Cicco and Patterson, 1980). The subject tract is within the Orogrande sedimentary basin has been tested by a few wildcat wells in the Las Cruces area. Exxon Corporation drilled the Beard Ole Federal #1 well in Sec. 11, T. 23 S., R. 2 E. to a total depth of 4,001 ft bottoming in the El Paso Formation (IHS, 2013). The well was dry although perforation and drill stem tests were conducted in the Fusselman and El Paso formations.

A wildcat well was drilled by Clary & Ruther in Sec. 36, T. 23 S., R. 2 E. to a total depth of 2,585 ft (IHS, 2013). The well bottomed in Mississippian strata and oil and gas shows were reported throughout the Mississippian section.

Both of these wells were drilled on a structural high formed by a horst block that trends northwest under the subject lands (Fig. 6). However, the structure is near an inferred volcanic caldera of Tertiary age. The volcanic activity would tend to destroy hydrocarbon accumulations. The Beard Ole Federal #1 well tested most of the sedimentary section and found no promising

reservoirs. The well is close enough to the subject tract that one can confidently conclude that the potential for hydrocarbon resources is low, certainty level C.

### C. Geothermal

The subject tract is considered to be prospectively valuable for geothermal (De Cicco and Patterson, 1980). The tract is within a favorable geologic environment for geothermal resources and shares many of the same characteristics as the Tortuga Mountain area. The tract is on a low-relief horst block with a relatively thin alluvial cover and near a caldera system, ideal structure for convective geothermal flow. The potential for geothermal resources is high, certainty level B. The likelihood that this tract will be explored and/or developed within the next few decades is probable considering the demand for alternative energy sources.

Geothermal development would involve the construction of a few wells and pipelines and create a minimal footprint. The proposed R&PP use of the land should not cause surface interference with geothermal development as most of the tract will remain open space. In fact, geothermal development could be beneficial as geothermal could be used to heat the proposed fire and police stations.

### D. Sodium and Potassium

The subject lands are not valuable for sodium or potassium. The bedrock geology, which is predominantly marine carbonate, and the clastic basin fill, are not a favorable geologic environment for sodium and potassium salts. There is no potential for deposits of potassium and sodium, certainty level D.

### E. Metallic Minerals

The subject lands are several miles west of the Organ Mountains porphyry copper center and its related metal deposit types. The carbonate bedrock under the subject tract has potential to host replacement and epithermal vein deposits but the alluvial cover has precluded exploration. The mineral potential is undetermined and exploration is unlikely given the depth of burial.

### F. Uranium and Thorium

Uranium occurs in fluorite-barite epithermal veins hosted in carbonate rock in the southern Organ Mountains. Fourteen pounds of uranium oxide were produced from the Bishop Cap subdistrict (Fig. 6) of the Organ Mountains District in 1955 (McLemore and Chenoweth, 1989). Fluorite-barite veins occur in Tortugas Mountain but there are no reported occurrences of uranium. The carbonate bedrock beneath the subject tract has the potential to host uranium-bearing epithermal veins but the thick alluvial cover has precluded exploration. The mineral potential is undetermined and exploration is unlikely given the depth of burial.

## **G. Nonmetallic Minerals/Industrial Minerals**

Epithermal fluorite and barite veins occur in Tortugas Mountain and a small amount was mined in the early 20<sup>th</sup> century. The carbonate bedrock beneath the subject tract has the potential to host fluorite-barite epithermal veins and replacements but the thick alluvial cover has precluded exploration. The mineral potential is undetermined and exploration is unlikely given the depth of burial.

## **H. Common Variety Minerals**

Sand and gravel deposits occur on the subject lands and have been mined in the past. There are inactive sand and gravel pits which were mined on mining claims located prior to 1955 and from BLM mineral material leases. The potential for sand and gravel deposits is high, certainty level D. Surface mining would disturb 10 acres or more for pits and stockpile/processing areas and would conflict with the proposed surface use.

## **V. Conclusions and Recommendations**

The subject tract has high potential for the occurrence of geothermal and sand and gravel resources. All other mineral resources are believed to have low, undetermined, or no mineral potential. The lands are classified as prospectively valuable for oil and gas but based upon the drilling results of a nearby exploratory well, there is very low potential for drilling on the subject tract for the foreseeable future.

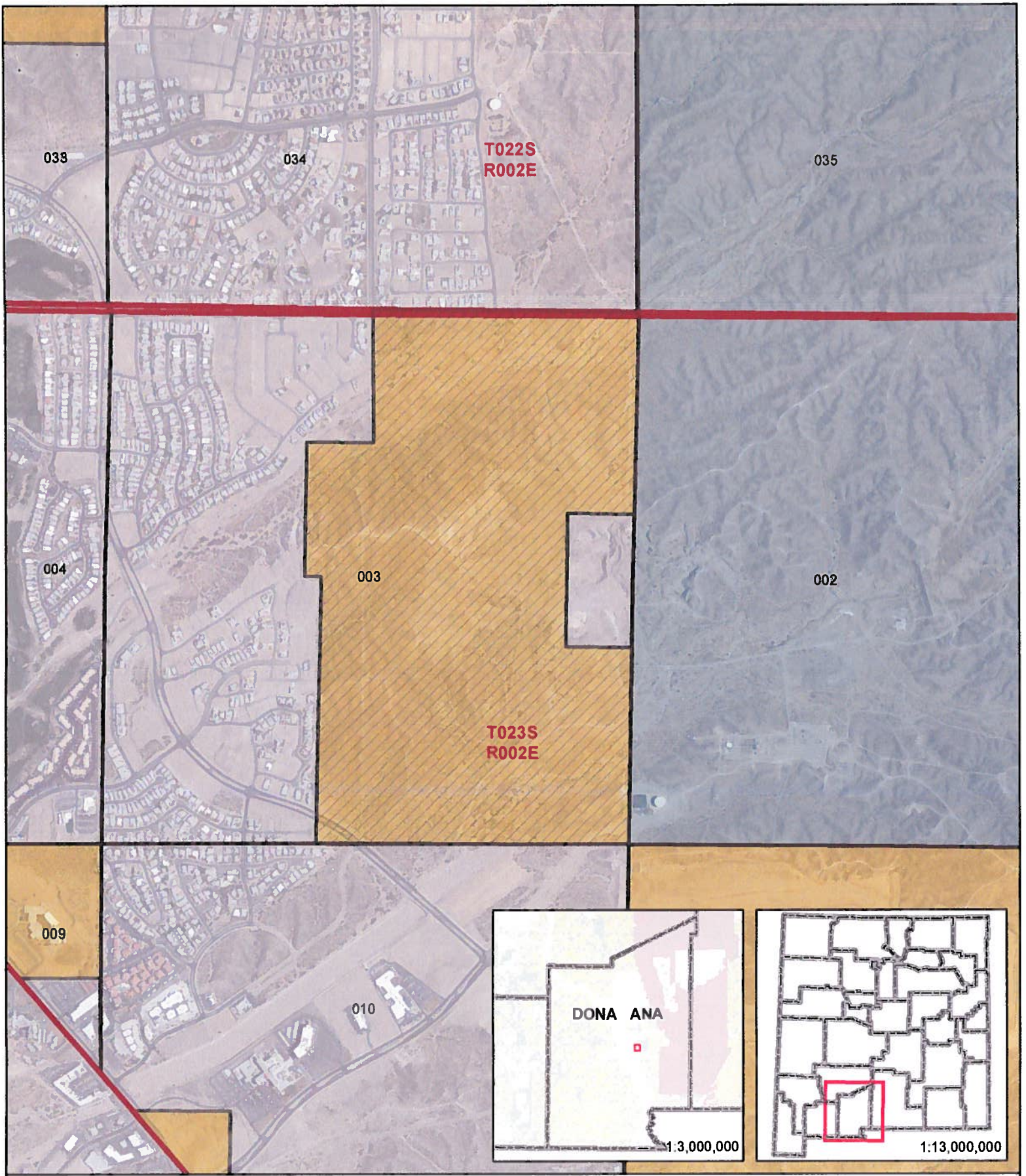
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I recommend that the proposed action be approved based upon the low probability of surface interference with mineral development.

## VI. References

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# City of Las Cruces Public Safety Complex R&PP Figure 1 NMNM 128496

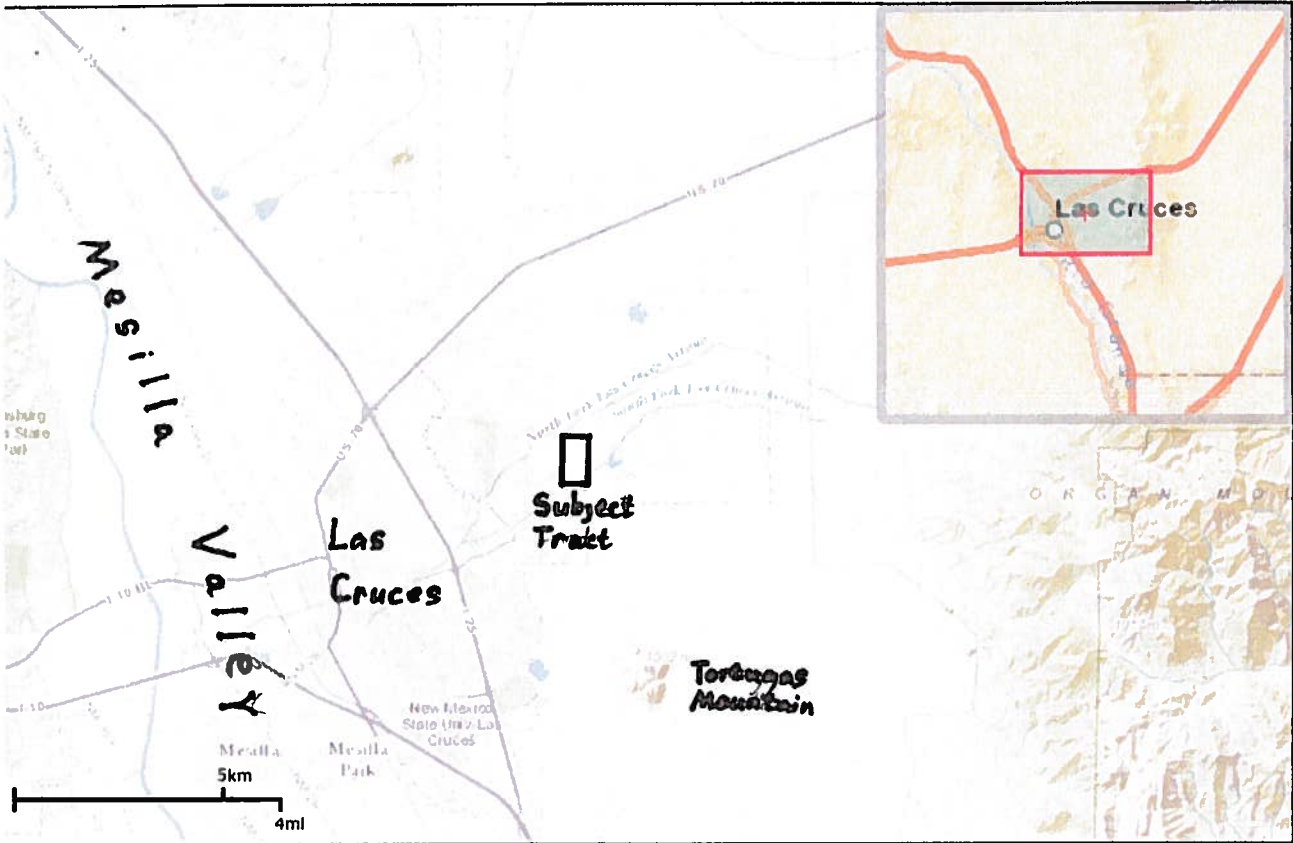
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- NMNM 128496
- Townships
- Sections
- BLM
- State
- Private



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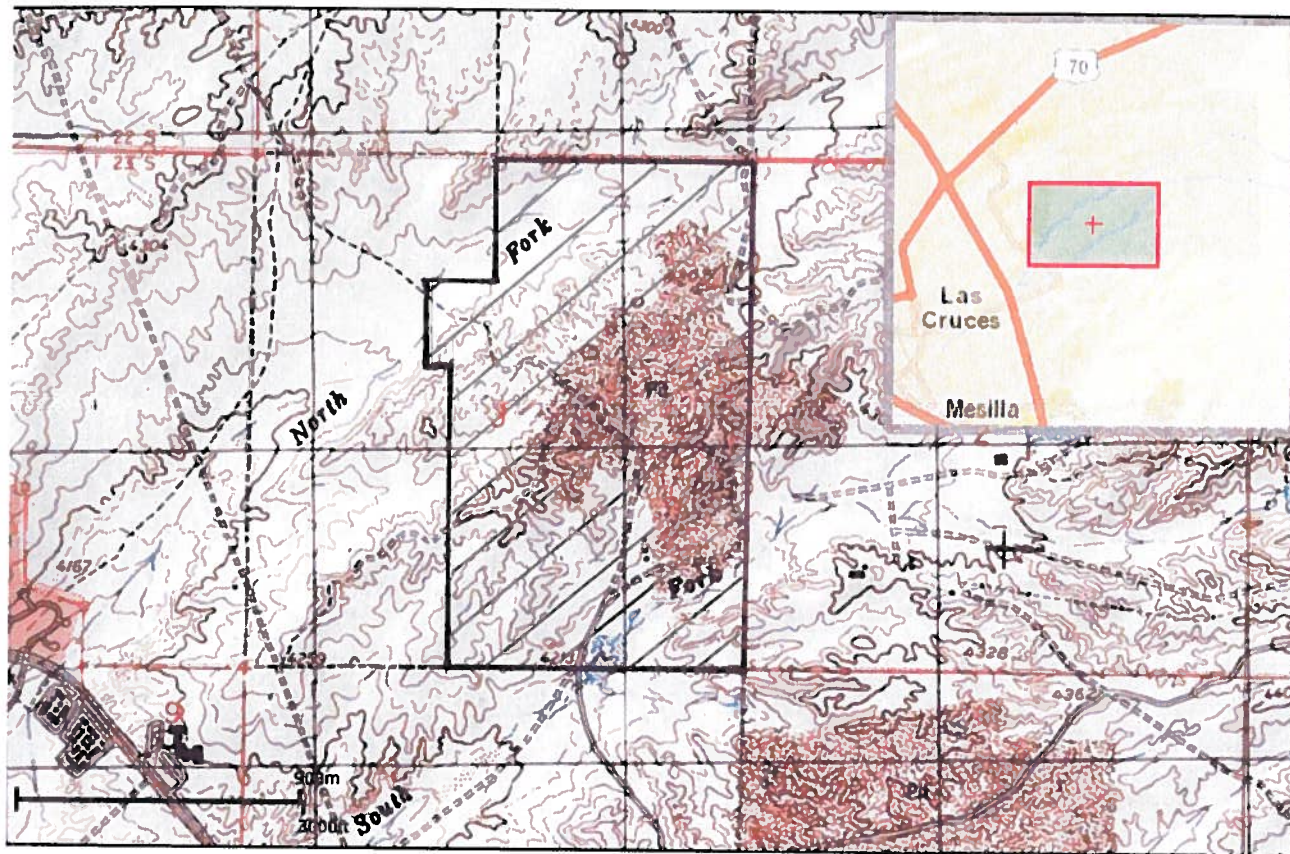
BLM Base Map



Sources: USGS, FAO, NPS, EPA, ESRI, DeLorme, TANA, and other suppliers

Figure 2. Physiographic map.

## BLM Base Map



Sources: USGS, FAO, NPS, EPA, ESRI, DeLorme, TANA, and other suppliers

Figure 3. Topographic map.



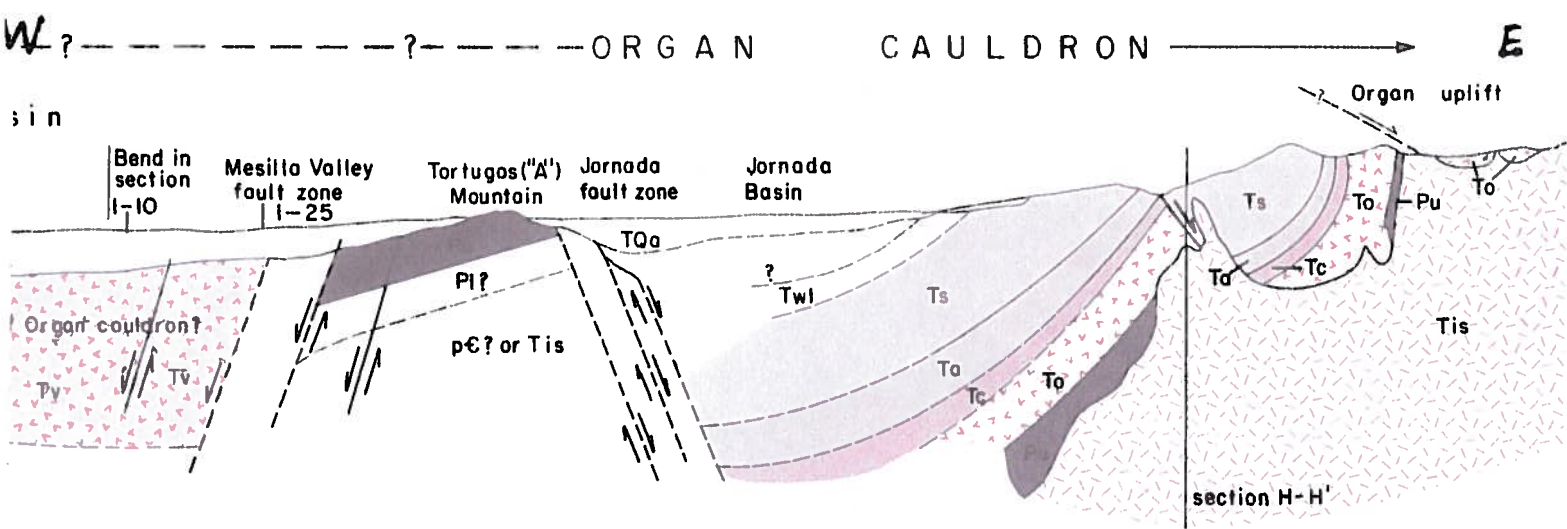
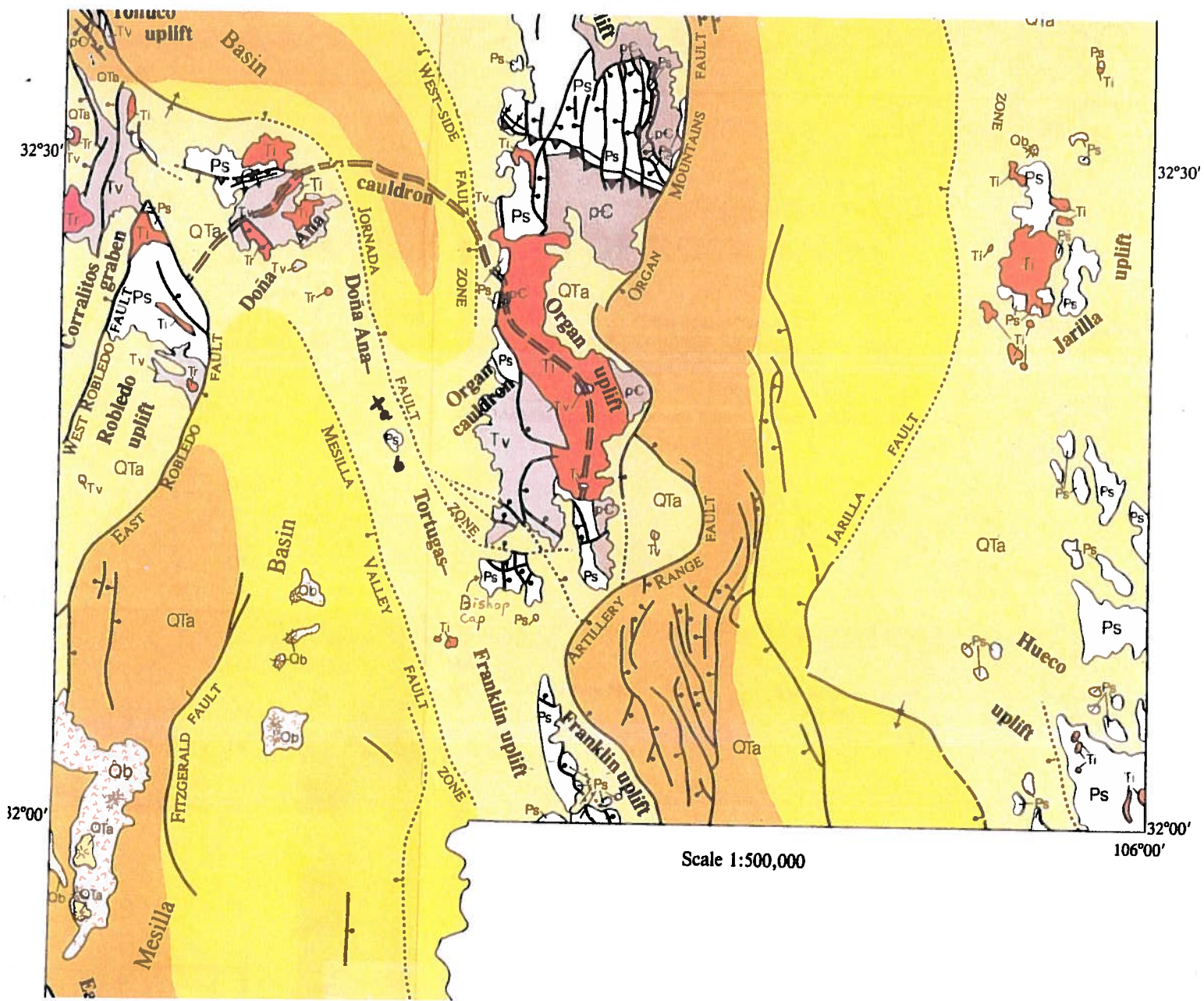


Figure 5. Geologic cross section. The subject tract is located near Tortugas ("A") Mountain. The faults bordering the host block are ideal conduits for convective geothermal waters. (from Seager et al., 1987).



s, 1960, M.S. thesis  
 r and J. W. Hawley, 1981, reconnaissance maps  
 r, 1961, M.S. thesis  
 1979, reconnaissance maps  
 s, 1981, 1982, reconnaissance maps  
 1979, reconnaissance map  
 r, J. W. Hawley, F. E. Kottowski, and W. E. King, in

107°00'

EXPLANATION

- Ob Quaternary basalt
- QTa Neogene basin fill and river deposits; deeper portions of basins are darker shaded, shallow portions lightest
- Tr Tertiary rhyolitic intrusive-extrusive complexes associated with the margins of the Doña Ana-Organ cauldron complex and Goodlight-Cedar Hills depression
- Tv Tertiary volcanic rocks and associated sedimentary rocks
- Ti Tertiary silicic to intermediate-composition, high-level plutonic rocks
- Ps Paleozoic, Mesozoic, and lower Tertiary sedimentary rocks
- pC Precambrian rocks, mostly granite

Figure 6. Tectonic Map. X marks the approximate location of the subject tract. Note its position within the Tortugas horst block. The location of the Exxon Beard Ole Federal #1 is noted with letter 'a' and the location of the Clary & Ruther wildcat well is noted with the letter 'b'. (from Seager et al., 1987).